Wireless Sensor Application Guide

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Important changes are listed in **Document revision history** at the end of this document.

Contents

Introduction

Carrier wireless sensors, designed for zone control, are low-power devices that use light-harvesting through solar panels as their primary power source. The wireless line of sensors includes the models shown in the table below. Wireless sensors communicate with the HVAC system through the Wireless Adapter that is wired to the Rnet port of a controller.

A wireless sensor's functionality is determined by:

- The sensor model (Standard, Plus, Pro-F, Motion/Lux, and Window/Door)
- The sensor's sensing capabilities (temperature, humidity, motion, lux and door contact)
- The control program that runs the associated equipment

To use Carrier wireless sensors, you must have:

- A i-Vu® v6.5 or later system
- v6-00 or later drivers

Sensors & Wireless Adapter	Options/Features
	Standard A Standard can be purchased in the following configurations: • Temperature only • Temperature and humidity • Temperature through a remote thermistor (field supplied)
	Plus A Plus has setpoint adjustment and can be purchased in the following configurations: • Temperature only • Temperature and humidity

Sensors & Wireless Adapter	Options/Features
	Pro-F A Pro-F has the following: • Temperature, humidity, and motion sensor • Setpoint adjustment • Fan control • Digital display (non-programmable)
	Motion/Lux Sensor • Motion sensor • Lux sensor • LED status indicator
	Window/Door Sensor • Magnetic relay switch • LED status indicator
	Wireless Adapter • USB update port • LED status indicator • Reset button • Rnet connector • 24 Vac power connector

This document

This document describes how to create control programs for wireless sensors in the Snap application. To use this guide, you need a working knowledge of control programs and the Snap application.

See the *Wireless Sensors Installation Guide* to plan the wireless network, set up communication, and install the devices.

Creating Snap control programs for wireless sensors

You can use up to 15 wireless sensors on a controller's **Rnet** port, but a control program can use no more than 5 wireless sensors. Use multiple control programs if your Rnet network has more than 5 sensors.

Do the following to create your control program:

Step 1: Add a Sensor Binder microblock (page 4).

Step 2: Add Analog Sensed Value Input microblocks (page 4).

Step 3: Add Binary Sensed Value Input microblocks (page 6).

Step 4: Add a BACnet Setpoint microblock (page 6).

Step 5: Add a BACnet Time Clock microblock (page 8).

See the Microblock Reference Help for a full description of each of the above microblocks.

Step 1: Add a Sensor Binder microblock

From the Snap **Net I/O** microblock menu, add 1 S BND **Sensor Binder** microblock to the workspace to enable communication between microblocks in the control program and up to 5 wireless sensors. Enter the following information in the Property Editor.

Sensor Configuration	The Index number is a reference number for each sensor that you define in this microblock. ASVI and BSVI microblocks will refer to the sensors by their index number.
Area	Type an intuitive name for the wireless sensor's location. This name will appear in the ASVI, BSVI, and Setpoint microblocks in the i-Vu® interface.
Network Type	Select **Rnet** for each wireless sensor that you define.
Address	The address (0-14) entered in SensorBuilder as the **Rnet ID**.

Step 2: Add Analog Sensed Value Input microblocks

From the **Net I/O** microblock menu, add one ASVI **Analog Sensed Value Input** (**ASVI**) microblock for each type of analog sensed value (zone temperature, humidity, signal strength, battery strength, or lux) that you want to retrieve from the wireless sensor(s). For example, the first ASVI may retrieve zone temperature, and the second may retrieve humidity, etc. A control program can have only one ASVI for each type of sensed value. Enter the following information in the Property Editor.

<table>
<tr><td>Rnet Tag</td><td>The Rnet tag determines which value (Zone Temp, Humidity, Signal Strength %, Battery Strength %, or Lux) is retrieved from the wireless sensor.

NOTE An ASVI microblock with the Battery Strength % Rnet tag has a value that is equal to the sensor's stored solar power or remaining battery power (whichever is greater).</td></tr>
<tr><td>Default Value</td><td>The value that the microblock outputs when communication with all enabled sensors fails or during sensor startup.</td></tr>
<tr><td>Units</td><td>The unit of measurement of the microblock's present value. Select from the BACnet engineering units in this droplist. For some microblocks, you can customize the droplist by selecting Options > Preferences > Droplist Options.</td></tr>
<tr><td>Index/Enable</td><td>The Index number corresponds to the wireless sensors defined in the Sensor Binder microblock. Check Enable for each sensor that you want to include in the combination algorithm used to determine the output value of the microblock.</td></tr>
<tr><td>Combination Algorithm</td><td>If using more than 1 sensor, select how the enabled sensors' values are to be combined to determine the microblock's output value. When the calculation is performed, only sensors with a valid value are included.</td></tr>
<tr><td>COV Increment</td><td>To reduce Rnet traffic, you can force the microblock to update its output only when the sensed value changes by more than the COV Increment.</td></tr>
<tr><td>Display Resolution</td><td>Defines the resolution of the value to be displayed on the sensor. For example, 1 displays only integers (example: 74) and 0.5 displays values to the nearest 0.5 (example: 74.5).</td></tr>
<tr><td>Input Smoothing</td><td>If the raw value from the sensor changes frequently, you can select one of the following options to send out an average of several readings on the output wire.

<table><tr><th>Select...</th><th>To send out the...</th></tr><tr><td>None</td><td>Raw value</td></tr><tr><td>Minimum</td><td>Average of the last 2 readings</td></tr><tr><td>Medium</td><td>Average of the last 5 readings</td></tr><tr><td>Maximum</td><td>Average of the last 9 readings</td></tr></table></td></tr>
<tr><td>Input Resolution</td><td>The increment by which the microblock updates the value on its output wire in a running system.

The Resolution format is used to truncate the microblock’s actual value. For example, if you enter a value from:
0.1 to 0.9, the wire displays 1 digit to the right of the decimal
0.01 to 0.99, the wire displays 2 digits to the right of the decimal
1 or greater, the wire displays a whole number
The Resolution value determines the increment by which the present value is updated. For example, if you enter:
.2, the wire displays 8.4, 8.6, 8.8, ...
.03, the wire displays 5.09, 5.12, 5.15, ...
10, the wire displays 30, 40, 50, ...</td></tr>
</table>

Step 3: Add Binary Sensed Value Input microblocks

From the **Net I/O** microblock menu, add one BSVI **Binary Sensed Value Input** (**BSVI**) microblock for each type of binary sensed value (motion or window/door contact) that you want to retrieve from the wireless sensor(s). For example, the first BSVI may retrieve sensed motion, and the second may retrieve door contact. A control program can have only one BSVI for each type of sensed value. Enter the following information in the Property Editor.

Rnet Tag	The Rnet tag determines which value (Sensed Occupancy or Contact Sensor) is retrieved from the wireless sensor.
Index/Enable	The Index number corresponds to the wireless sensors defined in the Sensor Binder microblock. Check **Enable** for each sensor that you want to include in the combination algorithm used to determine the output value of the microblock.
Combination Algorithm	If using more than 1 sensor, select how the enabled sensors' values are to be combined to determine the microblock's output value. When the calculation is performed, only sensors with a valid value are included.

Step 4: Configure setpoint properties

You can define setpoint properties using either of the following methods.

Method 1: Add a BACnet Setpoint microblock

The BACnet Setpoint microblock allows you to define the setpoint adjustment functionality for a wireless sensor and allows a Pro-F to display setpoint values that can be edited from the sensor.

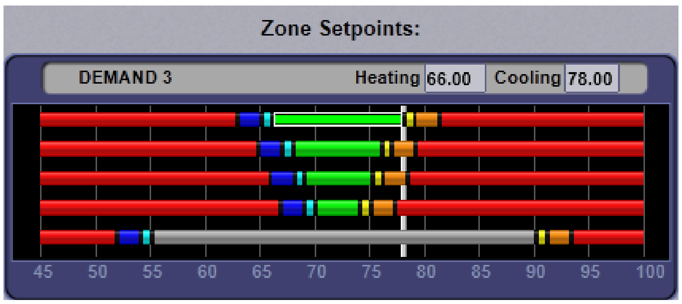
From the **Control** microblock menu, add a Spt B **BACnet Setpoint** microblock to determine how the user will interact with the sensor's Setpoint Adjustment screen. Enter the following information in the Property Editor.

Enable Rnet	Check to allow this microblock to communicate its value(s) to and from a wireless sensor.
Setpoint Adjust Limit (+/-)	The maximum amount (degrees) by which the user can adjust the zone's setpoints from a wireless sensor if an **Adjust setpoint offset** option is selected under **Sensor Setpoint Adjust Option**.
Clear adjustment on transition to unoccupied	Pro-F sensors - Check to have the Setpoint microblock reset the sensor's setpoint adjustment value to 0 each time the microblock's OCC input changes to false (off) and leave it at 0 when the OCC input changes again to true (on) or when the zone enters a timed local override condition. If this field is not checked, the Setpoint microblock will not reset the sensor's adjusted value for the next occupied period. **NOTE** The Setpoint microblock does not use adjusted values during unoccupied periods.
Edit Increment	The amount (degrees) that the zone temperature setpoint is adjusted by each press of a Pro-F's ▲ or ▼ button.

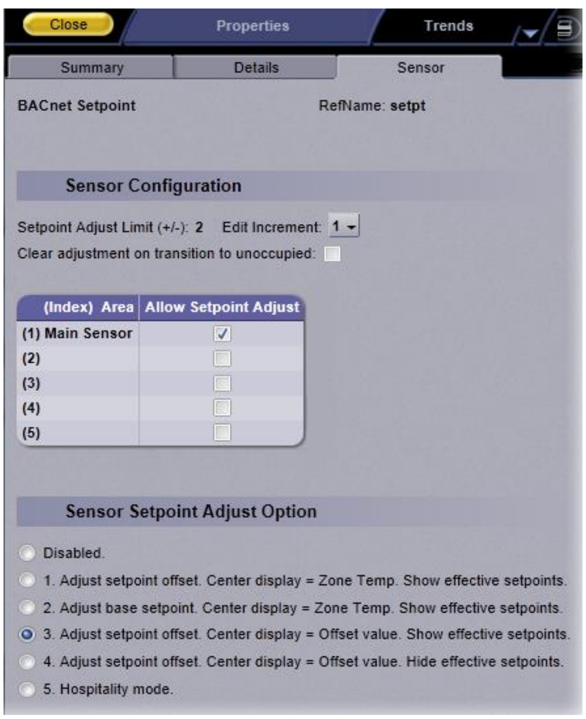
Method 2: Configure setpoint properties in i-Vu®

NOTE To enable/disable the setpoint adjustment functionality of specific sensors on the Rnet, in the i-Vu® interface, click the controller in the navigation tree, go to **Properties** > **Configuration** > **Setpoints** and adjust as follows.

<table>
<tr><th colspan="2">Setpoints for ZS and wireless sensors</th></tr>
<tr><td>To configure setpoint properties for ZS or wireless sensors, CTRL+click anywhere on the Zone Setpoints: graph at the top of the Setpoints section in order to access the Properties microblock popup.



</td><td></td></tr>
<tr><td>In the popup, on the Properties > Sensor tab, configure ZS or wireless sensors for Setpoint Adjust.



</td><td></td></tr>
</table>

Edit Increment – Amount of offset in degrees for each press of the up or down arrows on the ZS or wireless sensor for setpoint adjustment.	Default: 1 Range: 0.1 0.5 1
Allow Setpoint Adjust – Check to allow setpoint adjustments on the specified ZS or Carrier wireless sensor.	Default: (1) enabled Range: disabled/enabled
Sensor Setpoint Adjust Option – Check to select the ZS or wireless setpoint adjustment display.	Default: 3

Step 5: Add a BACnet Time Clock microblock

From the **Control** microblock menu, add a  **BACnet Time Clock with TLO and Override Status** microblock. Enter the following information in the Property Editor.

Enable Rnet	Check to allow this microblock to communicate its value(s) to and from a wireless sensor.

Programming specific applications

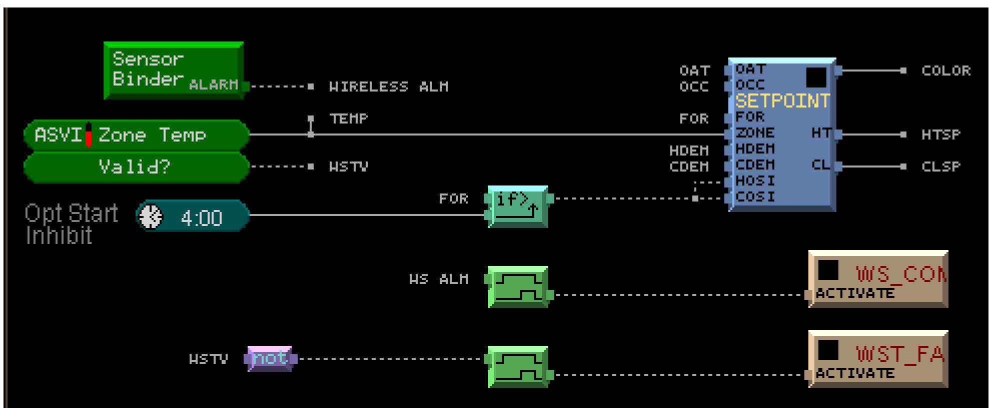
Generating alarms

You can add logic to a control program to generate an alarm for the following conditions:

- The Wireless Adapter has stopped communicating
- A sensor is not sending a valid value

Alarming for loss of communication with Wireless Adapter

1. Tie the Sensor Binder microblock's **Alarm** output to an Alarm microblock. The **Alarm** output will only go active if the Wireless Adapter loses communication.
2. Add a Delay On Make microblock to prevent nuisance alarms during startup or power failure.



Alarming for sensed values

1. The Sensor Binder microblock shows only the communication status of the Wireless Adapter, not the individual sensors. To detect if a sensor stops communicating, do the following:
2. Assign only one sensor to an ASVI or BSVI microblock.
3. Tie the **Valid** output to a not microblock since the valid output will be false when in alarm.
4. Attach an Alarm microblock to notify the user if the sensor in the ASVI or BSVI microblock has gone into error.
5. Add a Delay On Make microblock to prevent nuisance alarms during startup or power failure.

See the *Microblock Reference* for details of each microblock's alarming conditions.

Fan status and control

A wireless Pro-F sensor can let the user manually control fan speed

NOTE The Pro-F's button works only when the zone is occupied.

To program the sensor's button:

1. From the **Sys In** microblock menu, add a MSV **BACnet Multi-State Value Parameter** microblock.
2. On the Property Editor's **Rnet** tab, check **Enable Rnet**.
3. Select the **Fan Speed Request (600)** from the **Rnet Tag** drop-down list. Check **Editable**.

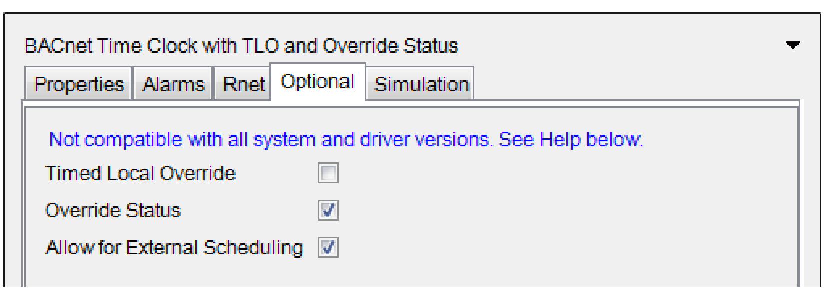
When a user presses the button, the screen initially shows the current fan speed. With each press of the button, the display shows one of the following options:

F0	Auto. The control program determines the speed.
F1	Low speed
F2	Medium speed
F3	High speed

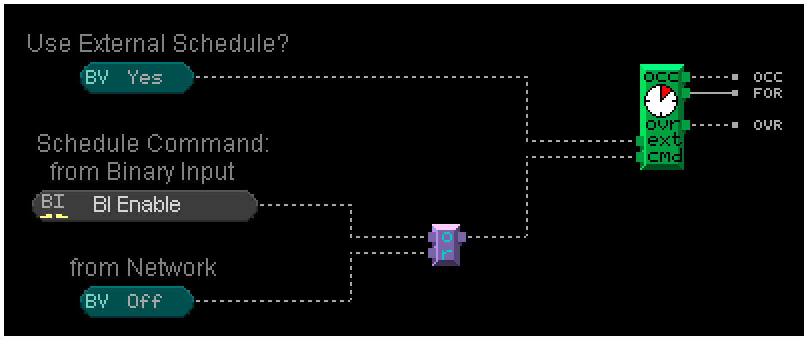
External Scheduling

The BACnet Time Clock microblock has 2 optional binary inputs that allow you to use an external schedule instead of the built-in scheduling of the running system.

Check **Allow for External Scheduling** on the microblock's **Optional** tab to enable the **ext** and **cmd** inputs.



The **ext** input tells the Schedule Microblock to use the external "commanded to" input instead of the internal schedule. When the top BV is on, the **cmd** input determines the schedule status. See example below.



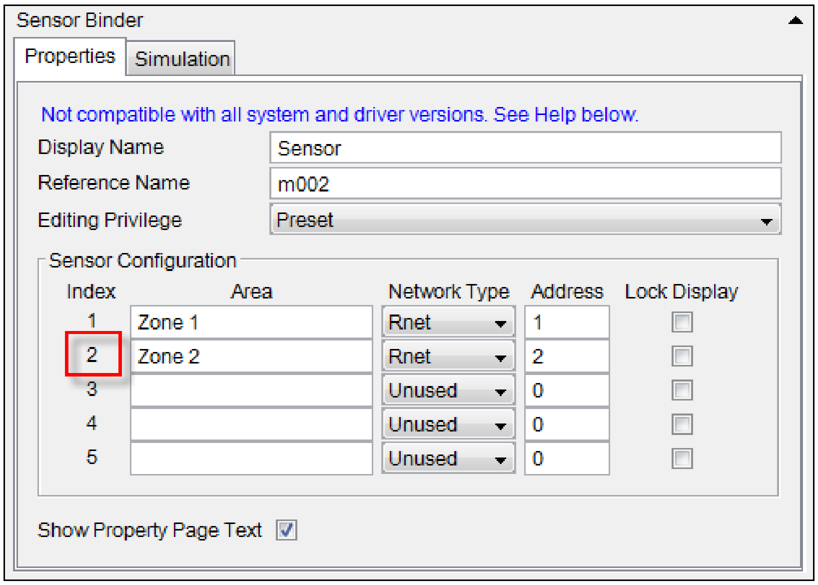
Setting Setpoint Adjust Limit from an external source

The BACnet Setpoint microblock has an optional analog input called **Setpoint Adjust Limit (-/+)** that takes over the role of the built-in parameter of the same name found on the microblock's **Rnet** tab in the Property Editor. Check **Setpoint Adjust Limit (-/+)** on the **Optional** tab to expose the **SPADJ** input. When this input is activated, the built-in parameter no longer works. For example, if the input value is 3, the user can adjust the zone setpoint up or down 3 degrees from the base. The adjustment applies to the cooling and heating setpoints.

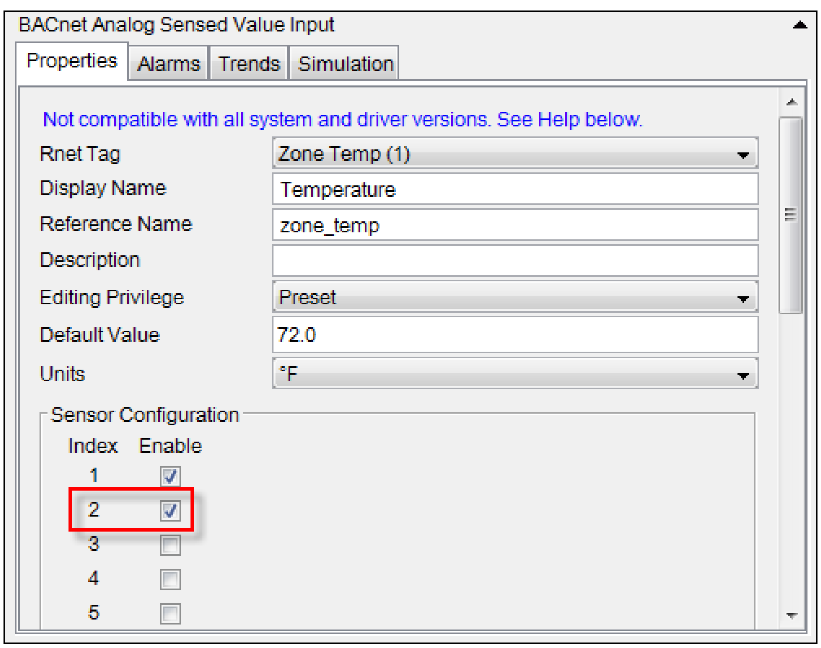
To use values from individual sensors in your control program

When using multiple wireless sensors on a single Rnet, an ASVI microblock outputs the average, minimum, or maximum value of the sensors. However, if you need to use the value of just one of the sensors, you can use an Analog Network Input (ANI) microblock that addresses a specific wireless sensor.

1 In the Snap application, select the Sensor Binder microblock and note the **Index** number for the sensor whose value you want to use.

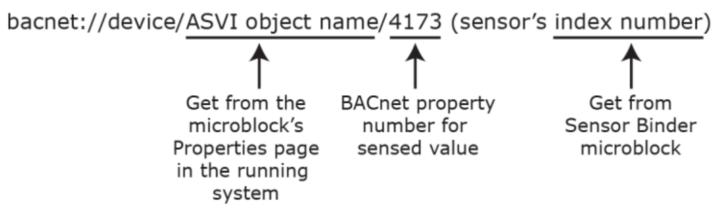


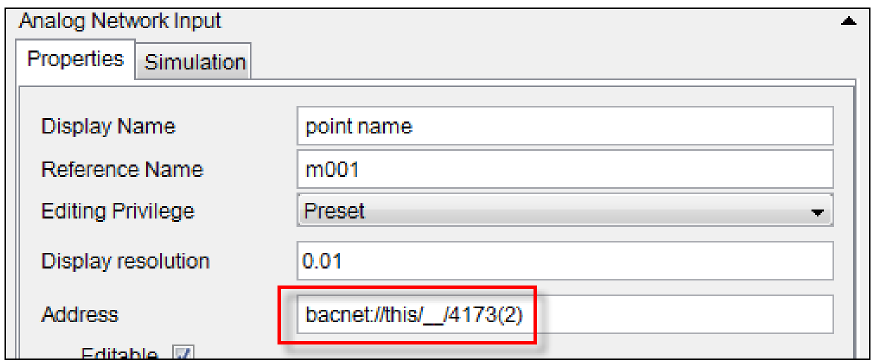
2 Verify that the sensor in enabled in the ASVI microblock.



NOTE By default, the microblock's **Display Name** and **Reference Name** are based on the Rnet tag, but you can change these if you want. In this example, the Display Name has been changed to **Temperature**.

3 In the ANI microblock, enter the **Address** in the following format, but leave out the ASVI object name. See example of address in the image below.





4 Select the controller on i-Vu's navigation tree.

5 Go to the **Properties** page > **Control Program** tab and expand **Configuration** > **Unit Configuration**. Ctrl+click on the ZS property name to open the ASVI popup.

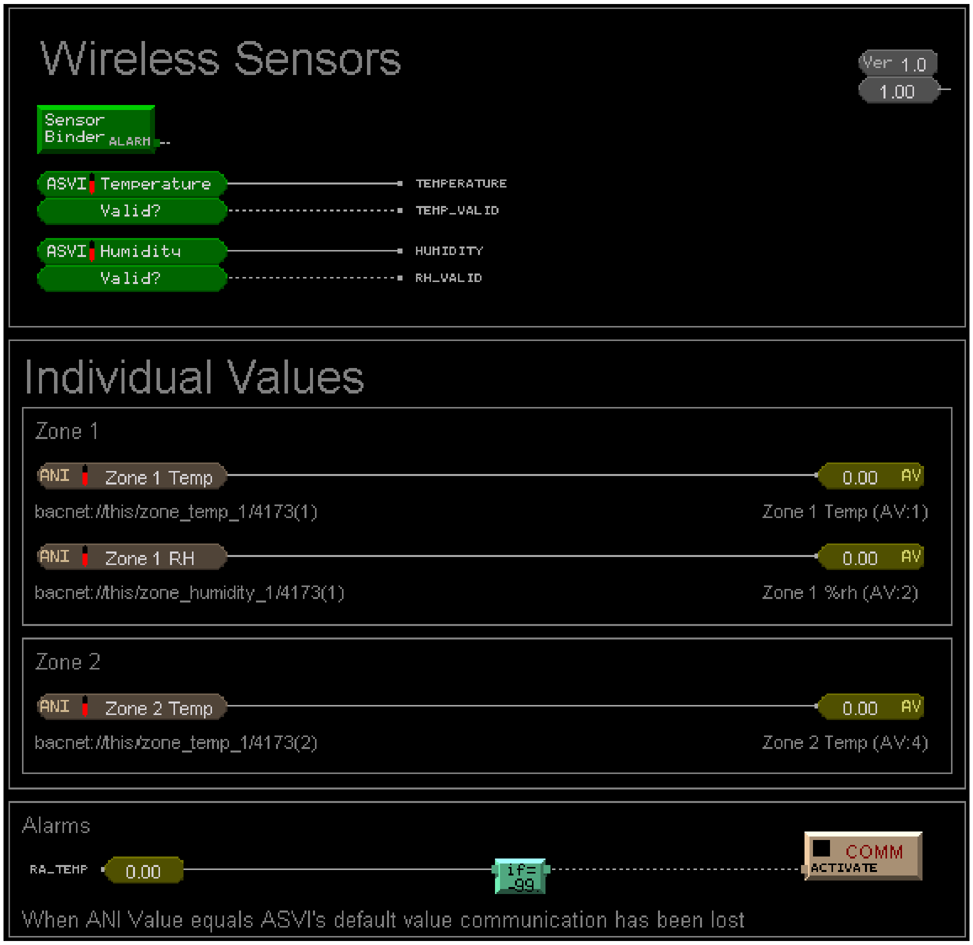
6 In the popup, on the **Properties** page > **Details** tab, scroll down to the **BACnet Configuration** section to get the **Object Name**.

7 On the zone's **Properties** page > **Network Points** tab, enter the Object Name in the ANI's address. For this example, the address would be:

bacnet://this/zone_temp_1/4173(2)

To use values from individual sensors in your control program

Example program:



Appendix A: Rnet tags

Rnet tags are numbers that identify types of system values. See the table below to find out the type of value an Rnet tag number represents.

Rnet Tags for Analog Values

Tag number...	Indicates this type of value...
001	Zone Temp
002	Zone Humidity
003	Zone CO2
004	Zone VOC
005	Signal Strength %
006	Battery Strength %
007	Lux
300	Outside Air Temp
301	Outside Air Humidity
302	Outside Air CO2
303	Mixed Air Temp
304	Supply Air Temp
305	Return Air Temp
306	Effective Cooling Setpoint
307	Effective Heating Setpoint
308	Air Flow
309	Primary Damper Position
310	Cooling Stage
311	Heating Stage
312	Cooling Valve
313	Heating Valve
314	Reheat
315	Secondary Damper Position
316	Supply Air Humidity
317	Return Air Humidity
318	Entering Water Temp
319	Leaving Water Temp
320	Supply Air Static Pressure
321	Return Air Static Pressure
322	Building Static Pressure
323	OA Dampers
324	RA Dampers
325	EA Dampers
326	SA Dampers
327	Economizer
328	Time Remaining Until Transition
329	Environmental Index
330	Demand Level
331	Cooling Airflow

Rnet Tags for Analog Values

Tag number...	Indicates this type of value...
332	Cooling Damper Position
333	Hearing Airflow
334	Heating Damper Position
400	Heating Setpoint Adjust
401	Cooling Setpoint Adjust
402	Occupied Heating Setpoint
403	Occupied Cooling Setpoint
404	Unoccupied Heating Setpoint
405	Unoccupied Cooling Setpoint
406	Occupied Humidity Setpoint
407	Unoccupied Humidity Setpoint
408	Occupied CO2 Setpoint
409	Unoccupied CO2 Setpoint
410	Minimum OA Damper %
411	Static Pressure Setpoint
412	OA Temp Cooling Lockout
413	OA Temp Heating Lockout
414	Changeover Temp
416	Air Flow Setpoint
417	Occupied VOC Setpoint
418	Unoccupied VOC Setpoint
419	Supply Air Temp Setpoint
420	Setpoint Adjust Limit
421	Cooling Airflow Setpoint
422	Heating Airflow Setpoint
500	Fan Speed Status
501	HVAC Zone Mode Status
600	Fan Speed Mode Request
601	HVAC Zone Mode Request

Rnet Tags for Binary Values

Tag number...	Indicates this type of value...
100	Fan Status
101	Fan Command
102	Cool Stage 1
103	Cool Stage 2
104	Cool Stage 3
105	Cool Stage 4
106	Heat Stage 1
107	Heat Stage 2
108	Heat Stage 3
109	Heat Stage 4

Rnet Tags for Binary Values	
Tag number...	**Indicates this type of value...**
110	Hot Gas Bypass
111	Reheat
112	Reversing Valve
113	Enthalpy Wheel Status
114	Dehum Wheel Status
115	Filter Status
116	Energy Save Mode
117	Occupied Status
118	Sensed Occupancy
119	Contact Sensor
121	Override Status
800	Temperature units (°F/°C) displayed on sensor

Rnet tag number...	Indicates this type of alarm...
1024	Generic Alarm
1025	High Zone Temp
1026	Low Zone Temp
1027	Filter Change Required
1028	High Discharge Air Temp
1029	Low Discharge Air Temp
1030	Supply Fan Failure
1031	Supply Fan in Hand
1032	Supply Fan Runtime Exceeded
1033	Exhaust Fan Failure
1034	Exhaust Fan in Hand
1035	Exhaust Fan Runtime Exceeded
1036	Supply Fan VFD Fault
1037	Cooling Coil Pump Failure
1038	Cooling Coil Pump in Hand
1039	Cooling Coil Pump Runtime Exceeded
1040	Heating Coil Pump Failure
1041	Heating Coil Pump in Hand
1042	Heating Coil Pump Runtime Exceeded
1043	High Zone CO2 Concentration
1044	High Zone Humidity
1045	Low Zone Humidity
1046	Smoke Alarm
1047	Sensor Failure
1048	Freezestat
1049	Emergency Shutdown
1050	Compressor 1 Runtime Exceeded
1051	Compressor 2 Runtime Exceeded
1052	OA Damper Failure
1053	OA Damper in Hand
1054	Enthalpy Wheel Failure

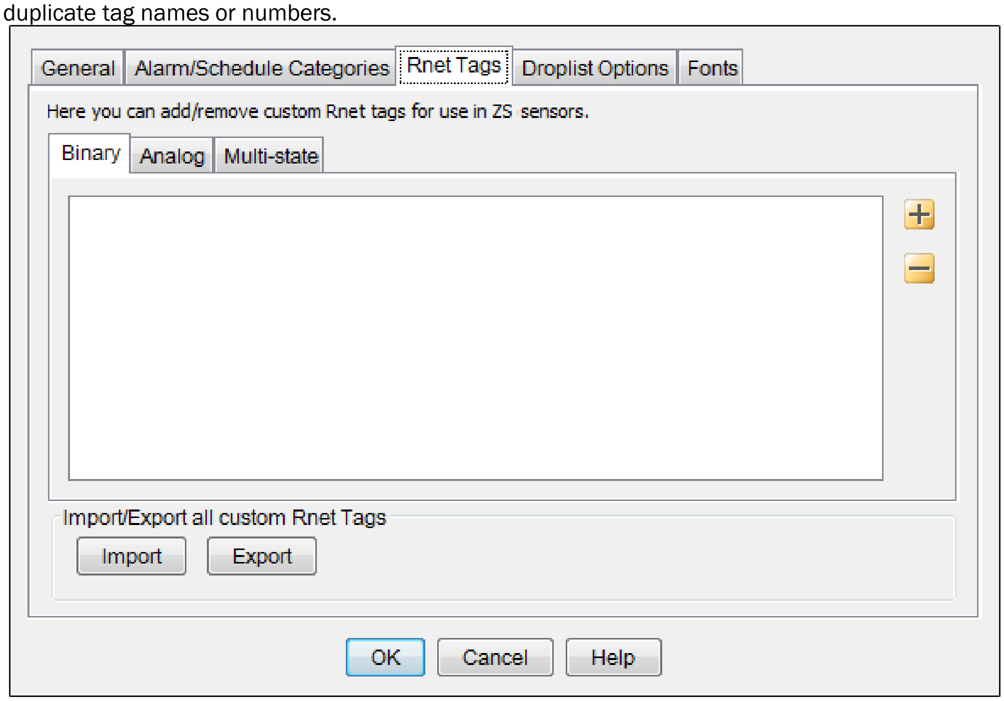
Rnet tag number...	Indicates this type of alarm...
1055	Enthalpy Wheel in Hand
1056	Enthalpy Wheel Runtime Exceeded
1057	Enthalpy Wheel High Discharge Air Temp
1058	Enthalpy Wheel Low Discharge Air Temp
1059	Enthalpy Wheel High Return Air Temp
1060	Enthalpy Wheel Low Return Air Temp
1061	Enthalpy Wheel High Exhaust Air Temp
1062	Enthalpy Wheel Low Exhaust Air Temp
1063	High Supply Air Humidity
1064	Low Supply Air Humidity
1065	High Mixed Air Temp
1066	Low Mixed Air Temp
1067	High Return Air Humidity
1068	Low Return Air Humidity
1069	High Return Air Temp
1070	Low Return Air Temp

Rnet tag numbers 1100–1999 are reserved for custom tags. See *Adding custom Rnet tags* (page 19).

A custom Rnet tag number beginning with...	Indicates...
11xx	A binary tag
13xx	An analog tag
15xx	A multi-state tag

Adding custom Rnet tags

You add custom Rnet tags in the Snap application. Select **Options** > **Preferences** > **Rnet Tags** tab. Do not duplicate tag names or numbers.



After you create a custom tag number, it automatically appears on the **Rnet Tag** drop-down list for that point type.

If you open a control program with custom Rnet tags on a different machine than the one it was created on, the custom tags automatically appear in the **Rnet Tag** drop-down list.

NOTE To copy all custom Rnet tags to another computer, click **Export**, then save the file. On the other computer, click **Import**, then select the exported file.

Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

Date	Topic	Change description	Code*
3/3/20	Cover	Updated logo	C-D
5/23/18	Introduction	Standard and Plus sensors were redesigned	X-D

* For internal use only